



## **Nitrogen uptake in temperate heath vegetation and soil microbes is influenced by elevated temperature, CO<sub>2</sub> and drought**

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BIOGEOMON 2009

# Nitrogen uptake in temperate heath vegetation and soil microbes is influenced by elevated temperature, CO<sub>2</sub> and drought

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clima!te



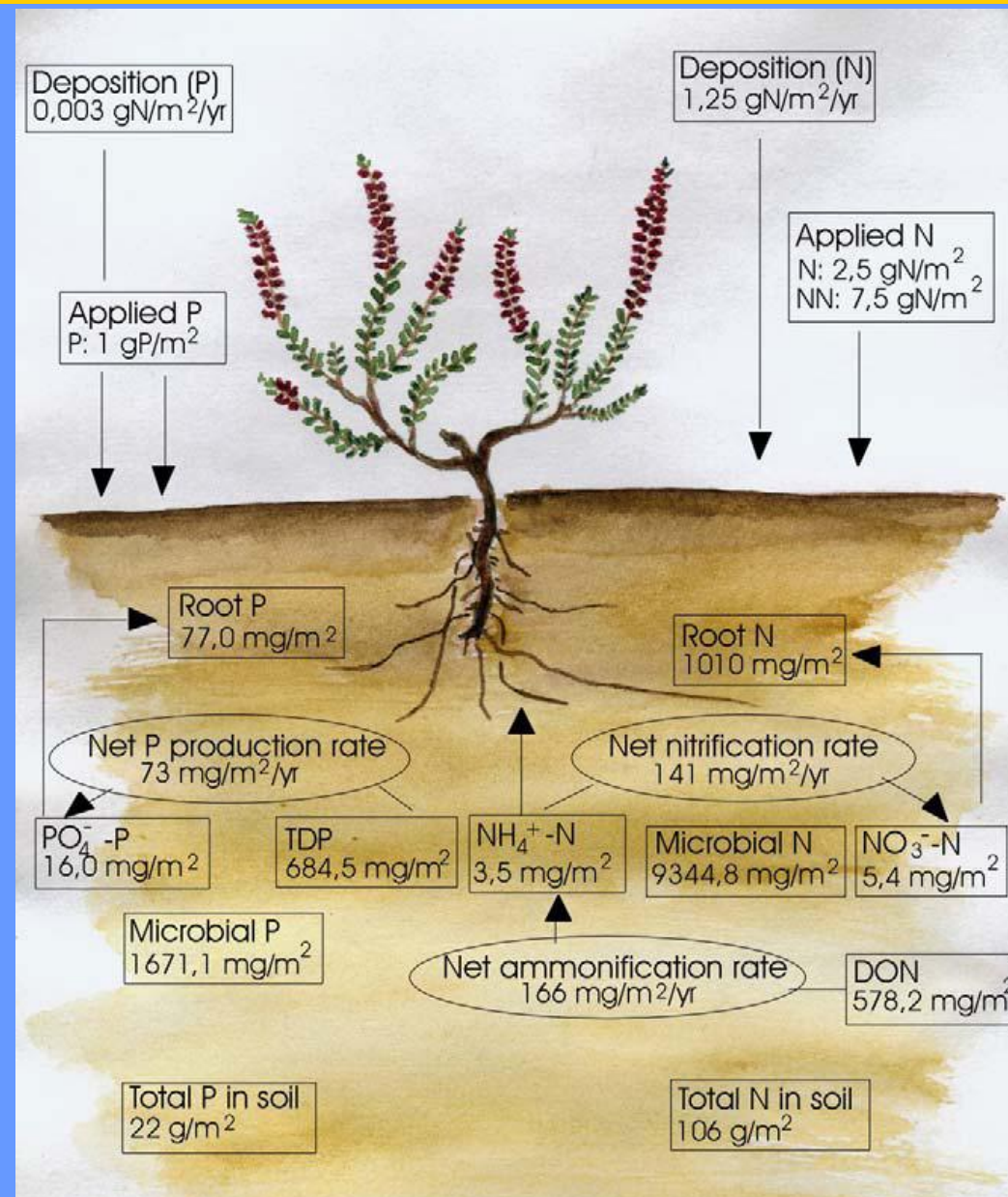


**Micobes: no effect  
from fertilization**

**Roots increase in  
biomass with N and  
NNP**

Applied Soil Ecology  
(2009); vol 42 279 – 287

Nielsen, Andresen,  
Michelsen, Schmidt and  
Kongstad

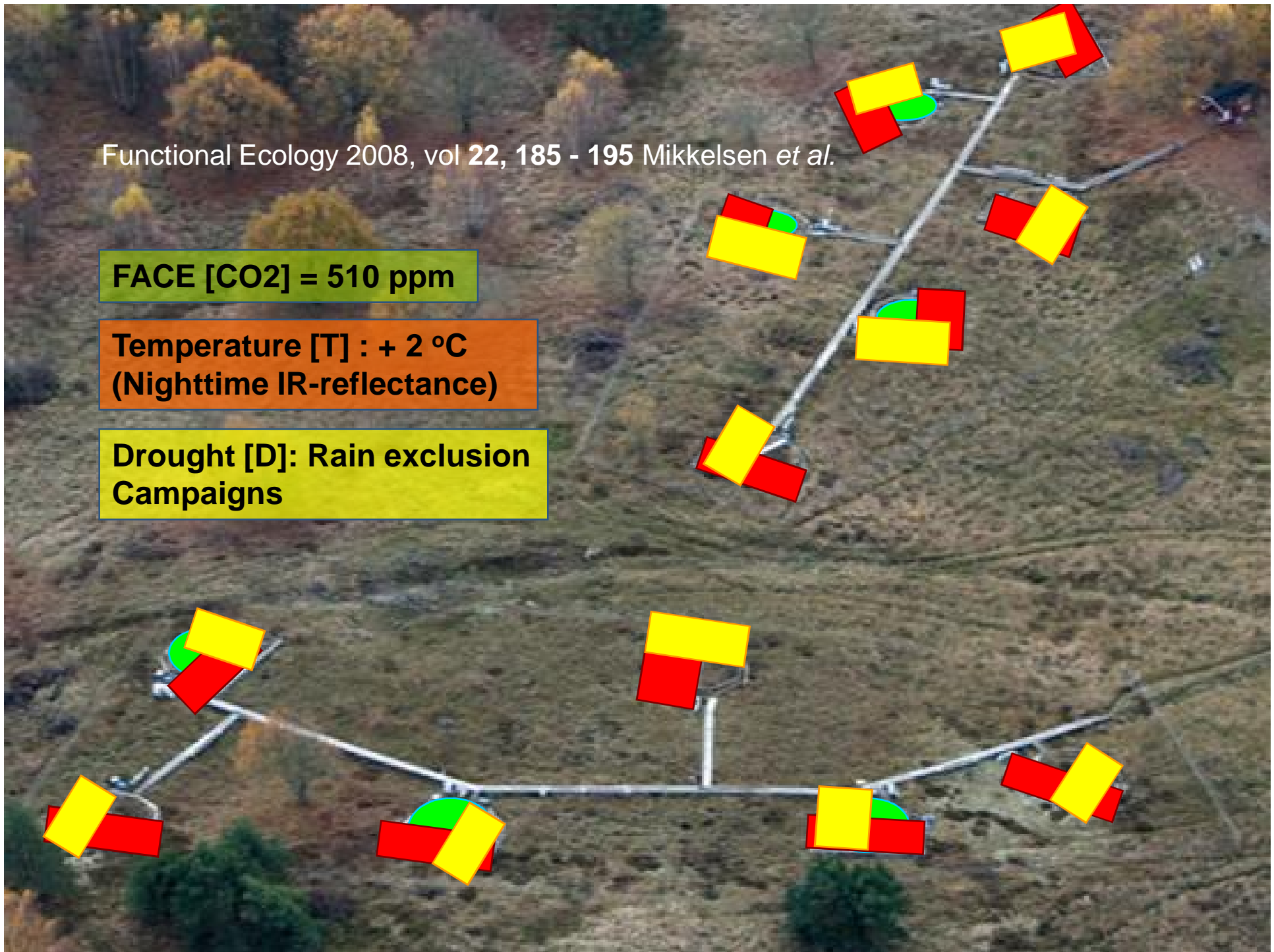


Functional Ecology 2008, vol 22, 185 - 195 Mikkelsen *et al.*

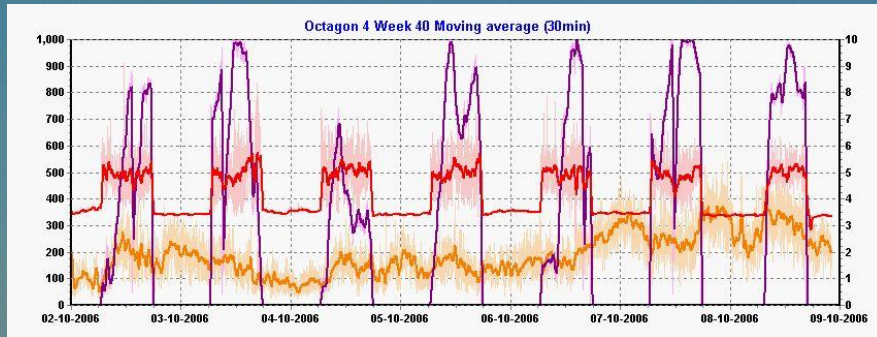
**FACE [CO<sub>2</sub>] = 510 ppm**

**Temperature [T] : + 2 °C  
(Nighttime IR-reflectance)**

**Drought [D]: Rain exclusion  
Campaigns**





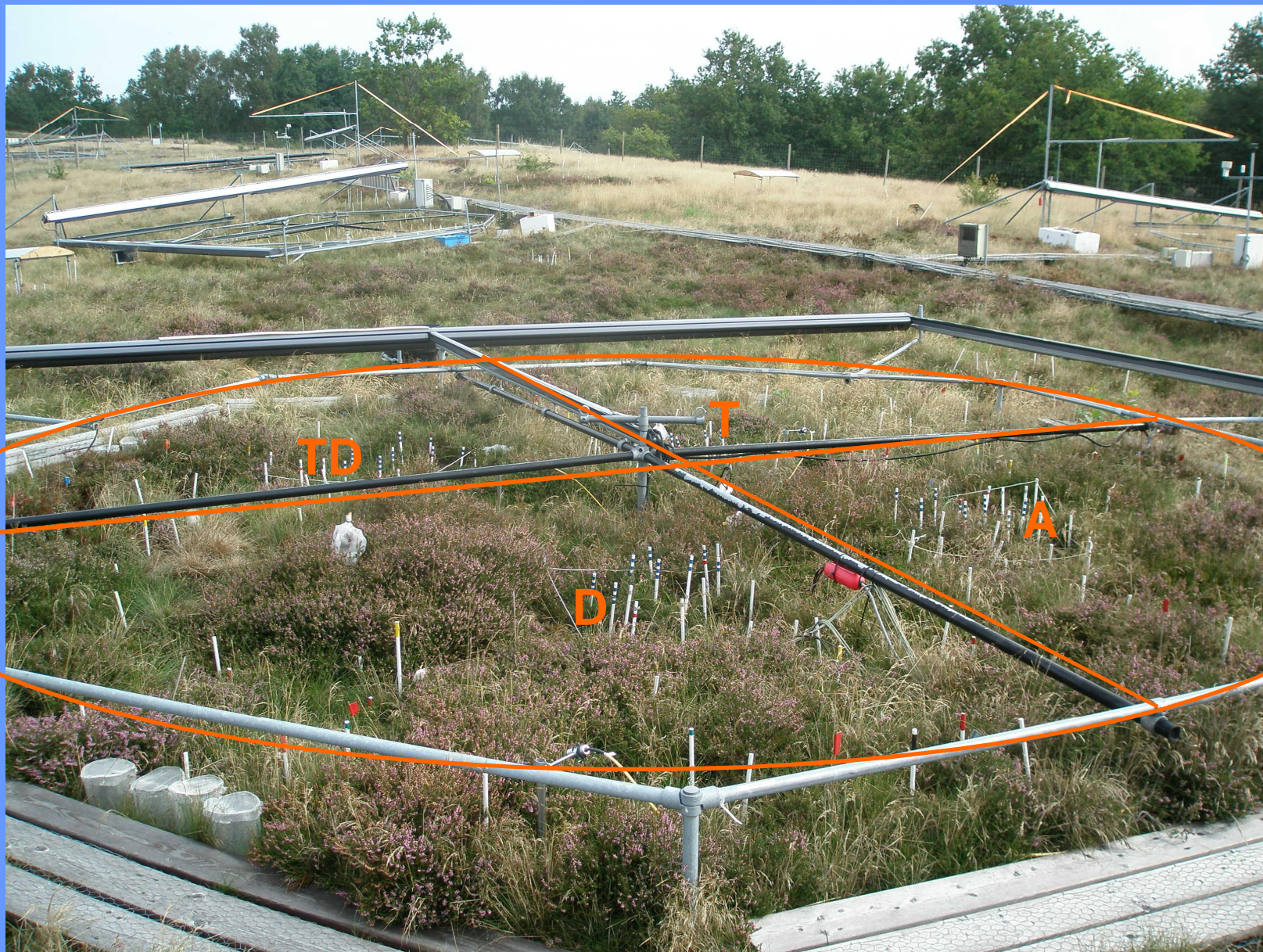




Glycine  $^{15}\text{N}$   $^{13}\text{C}_2$   
addition







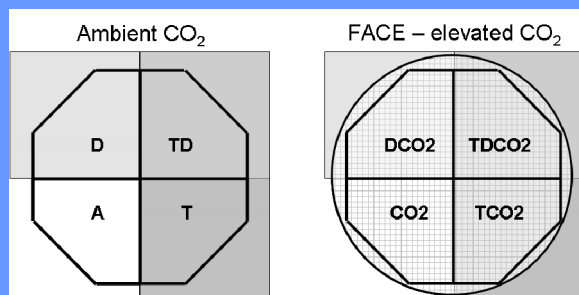




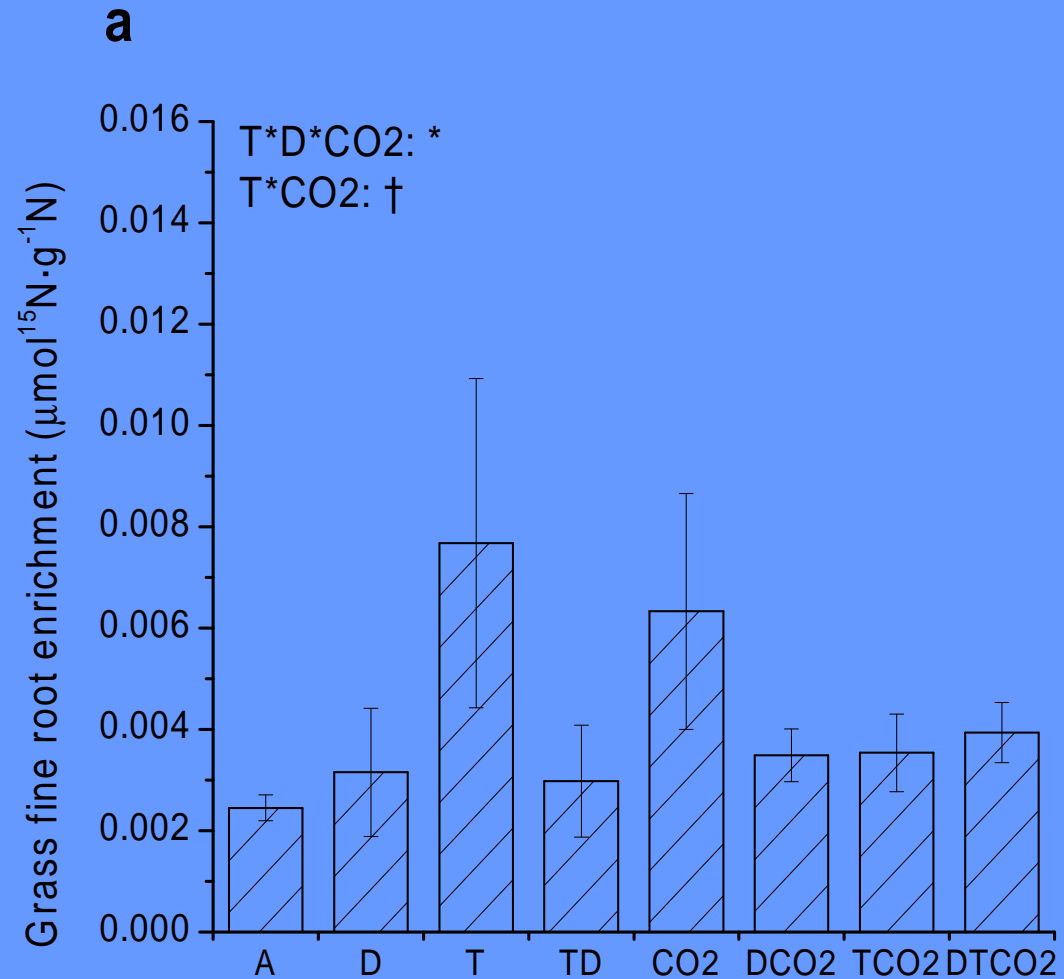
## Immediate root $^{15}\text{N}$ uptake:

T ↑

CO<sub>2</sub> ↑

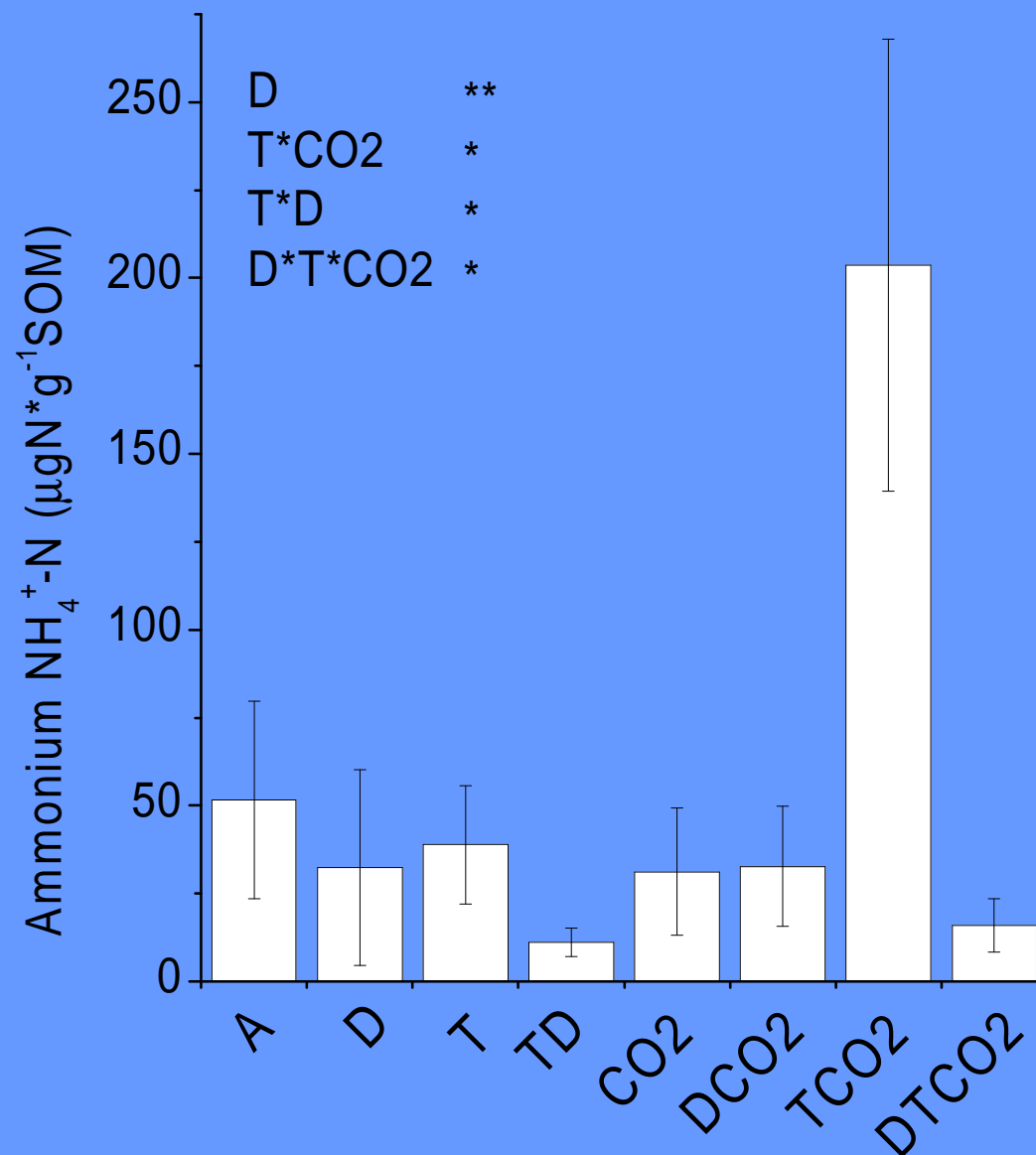
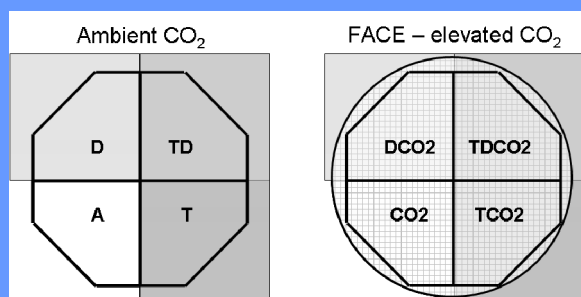


Submitted to Acta Oecologica (2009)  
Andresen, Michelsen, Jonasson, Ambus,  
Beier





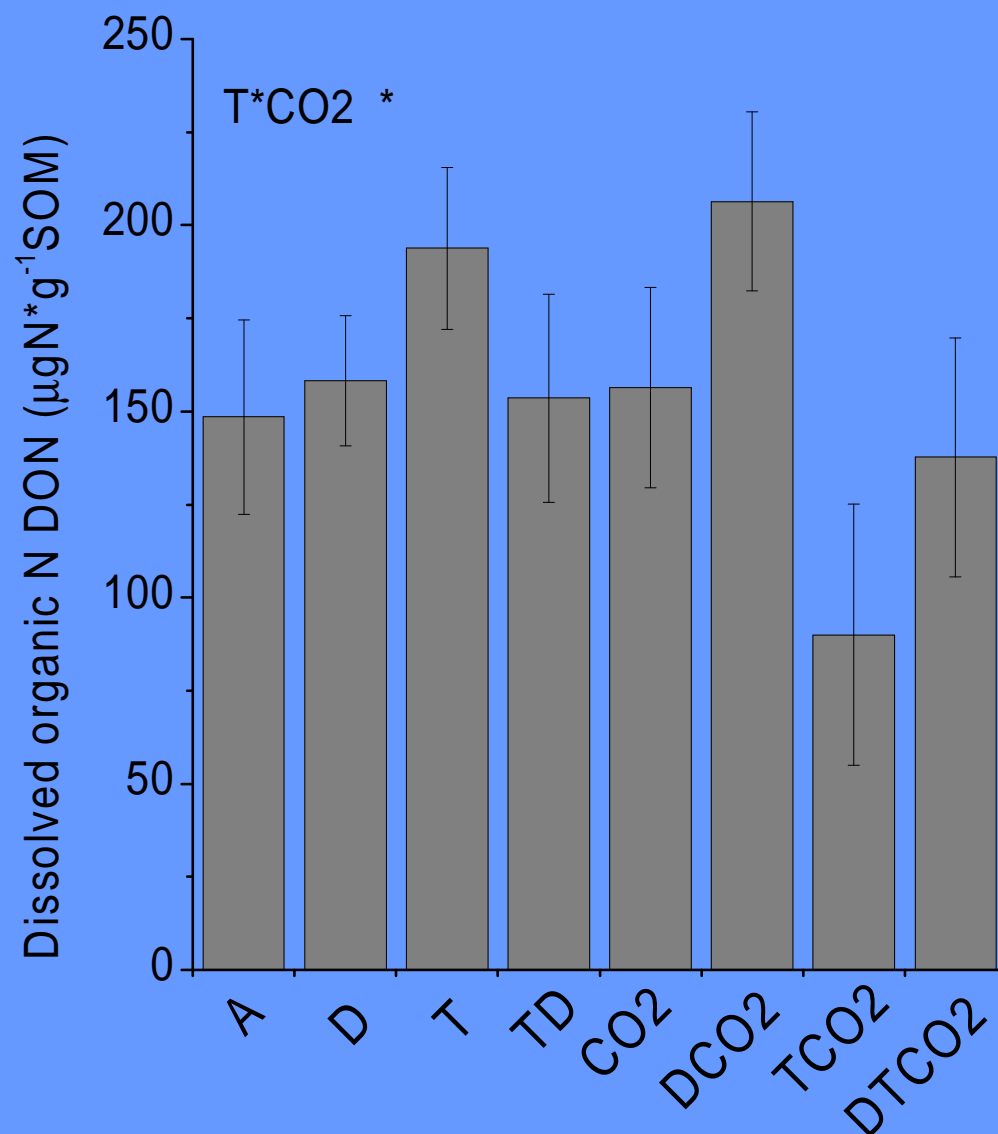
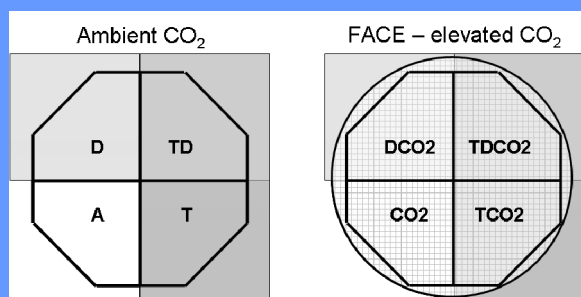
Ammonium  
concentration:  
 $\text{TCO}_2 \uparrow$







DON:  
TCO<sub>2</sub> ↓



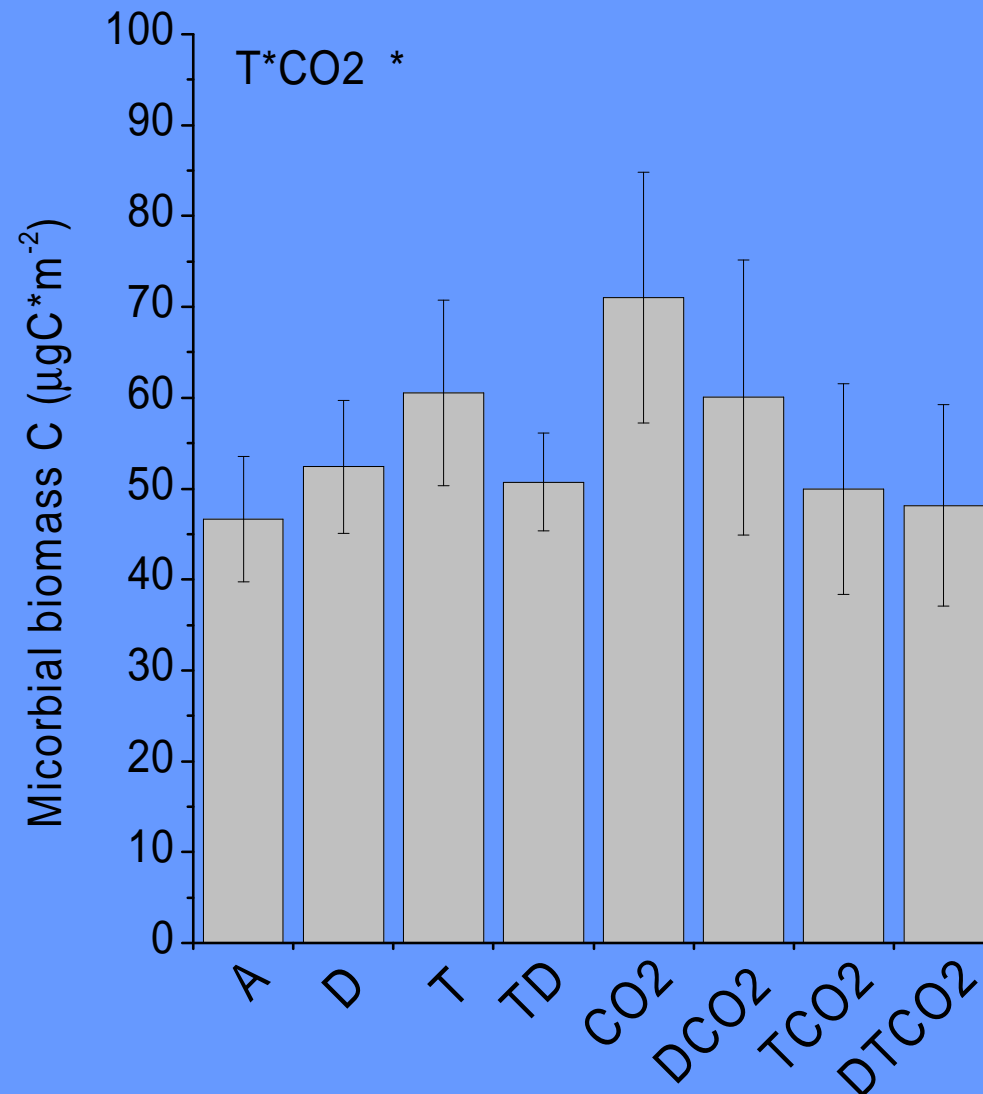
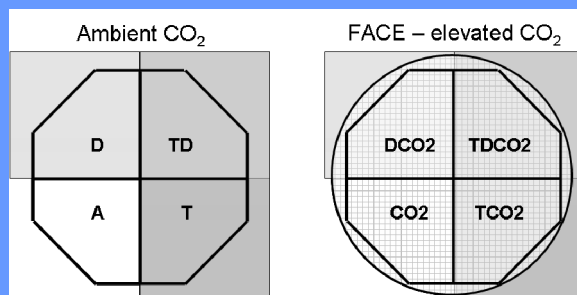


## Microbial carbon:

T ↑

CO<sub>2</sub> ↑

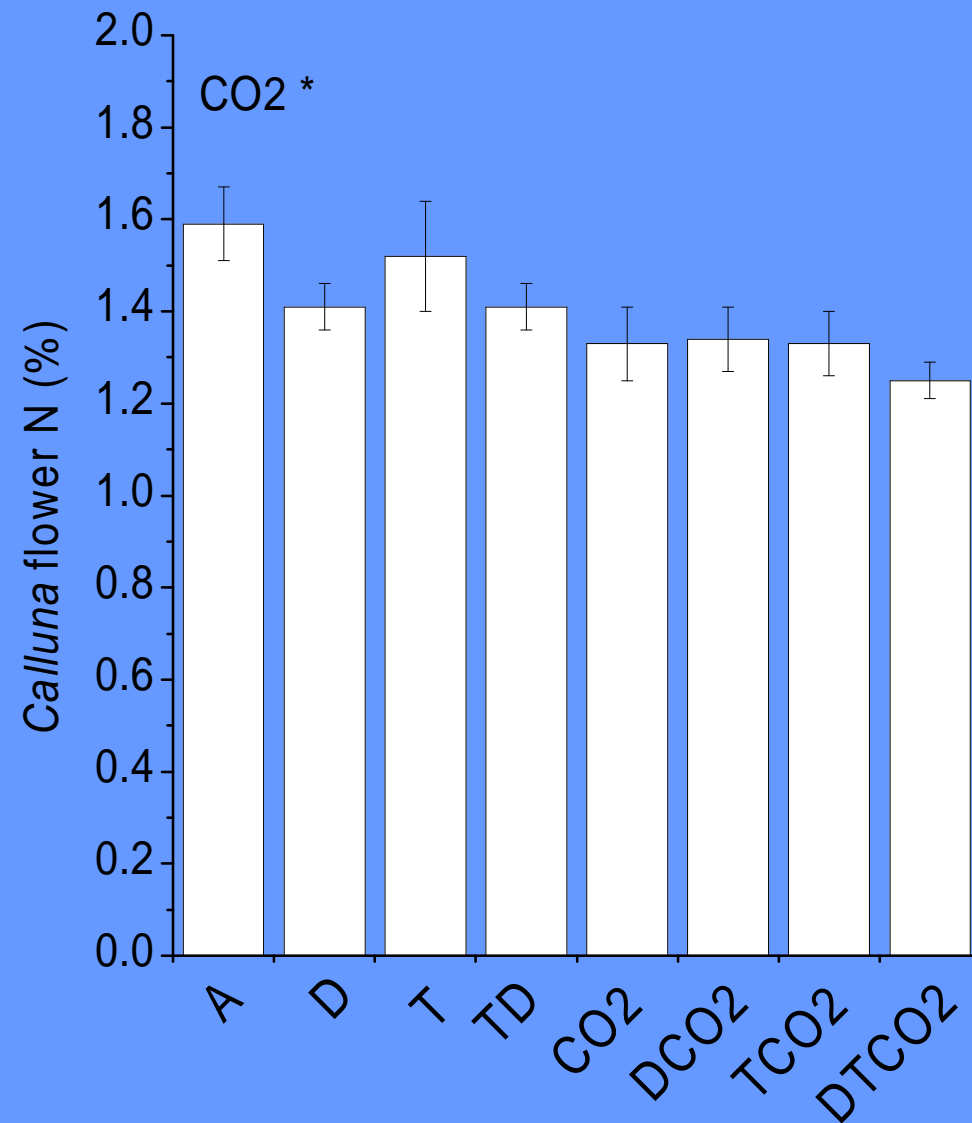
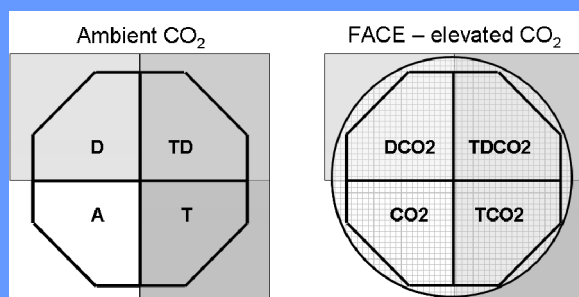
TCO<sub>2</sub> --







Heather  
flower N %:  
CO<sub>2</sub> ↓

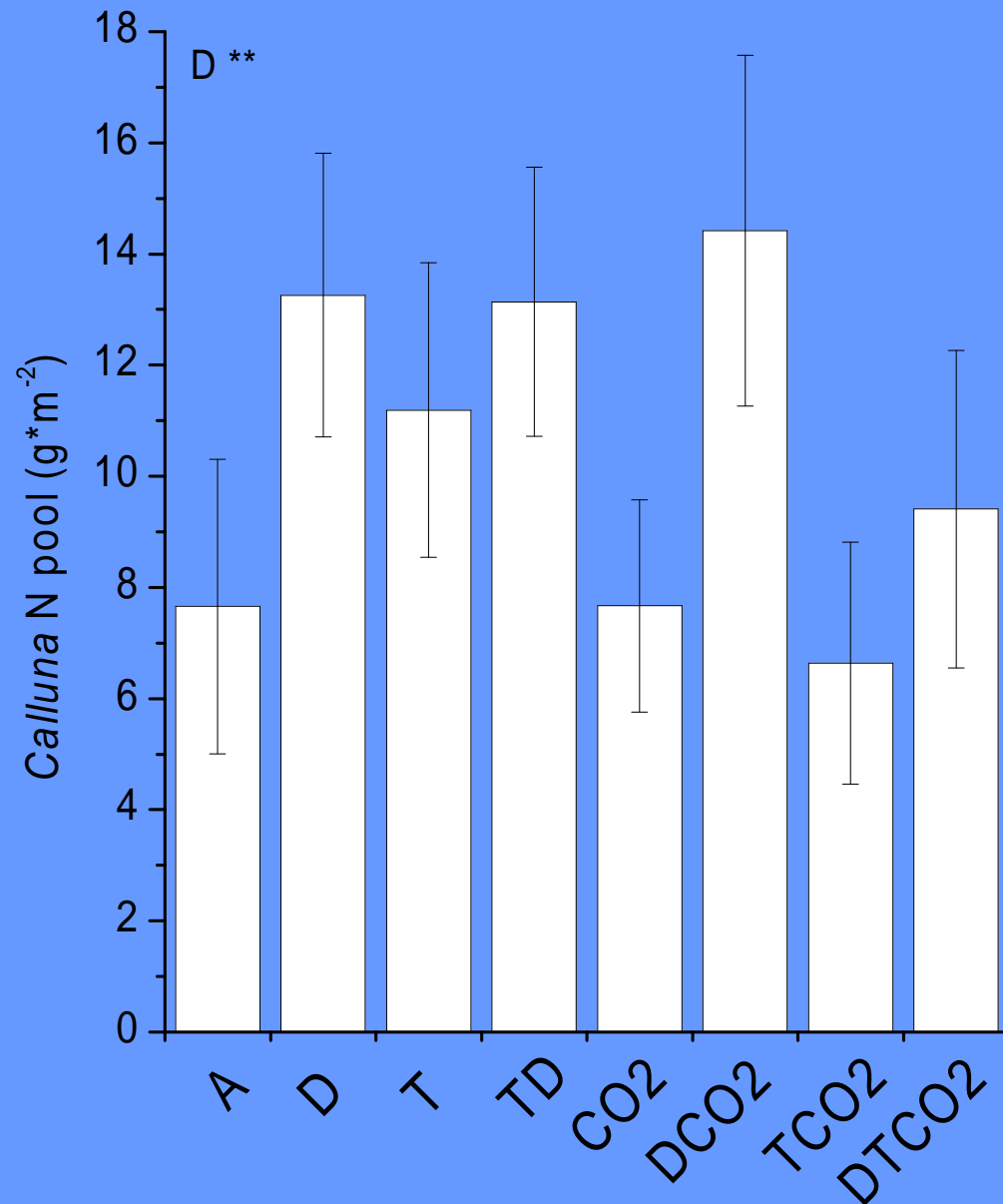
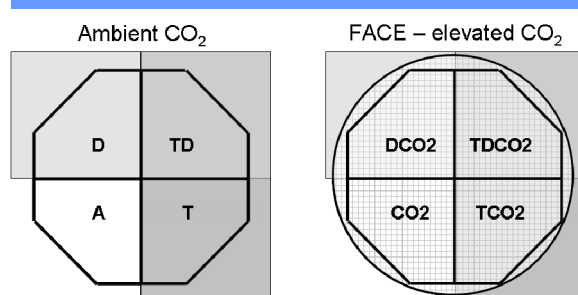




Heather

N pool:

D ↑



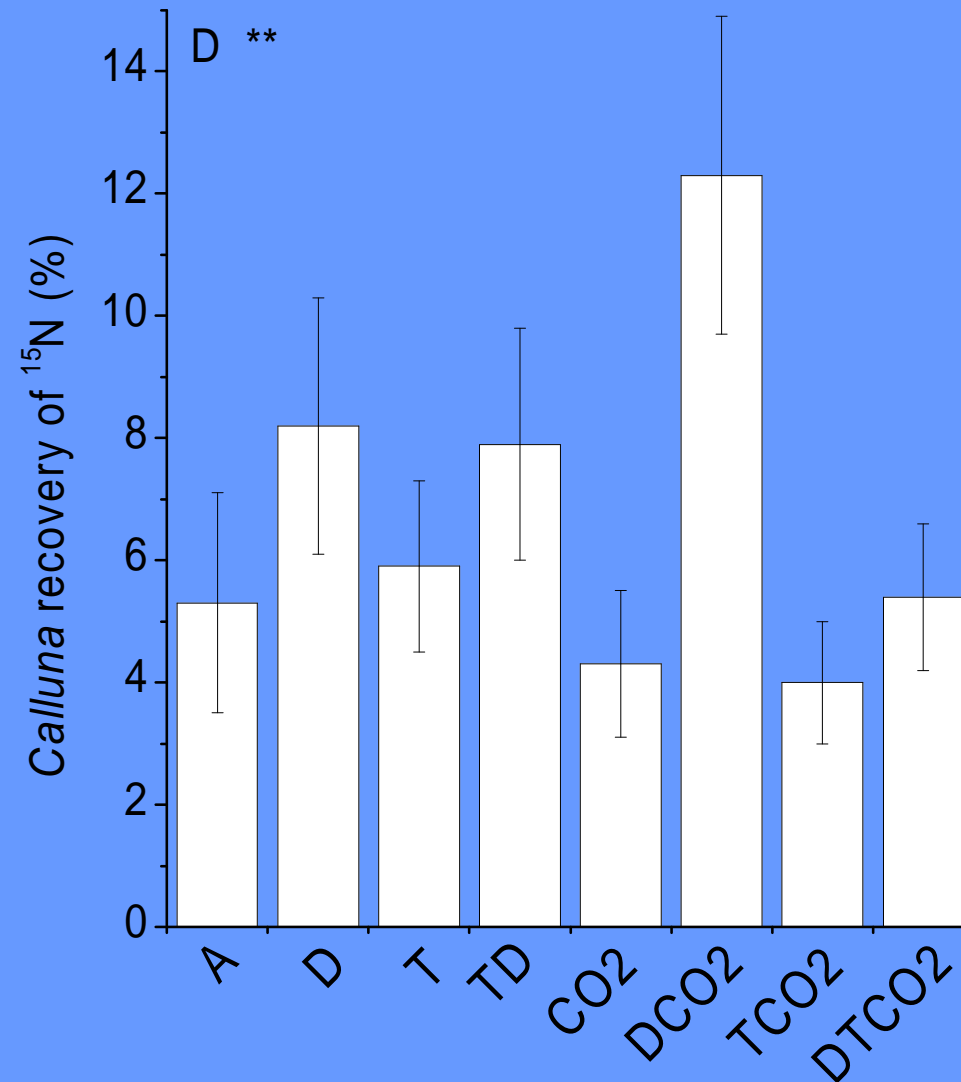
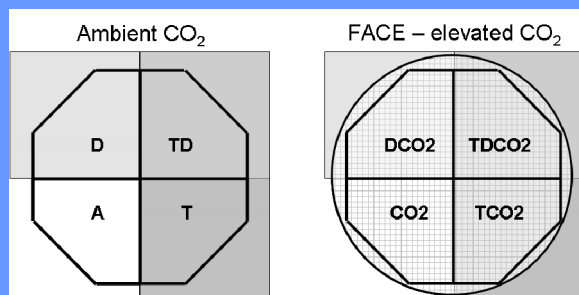




## Heather

$^{15}\text{N}$  recovery:

D ↑





**Nitrification**

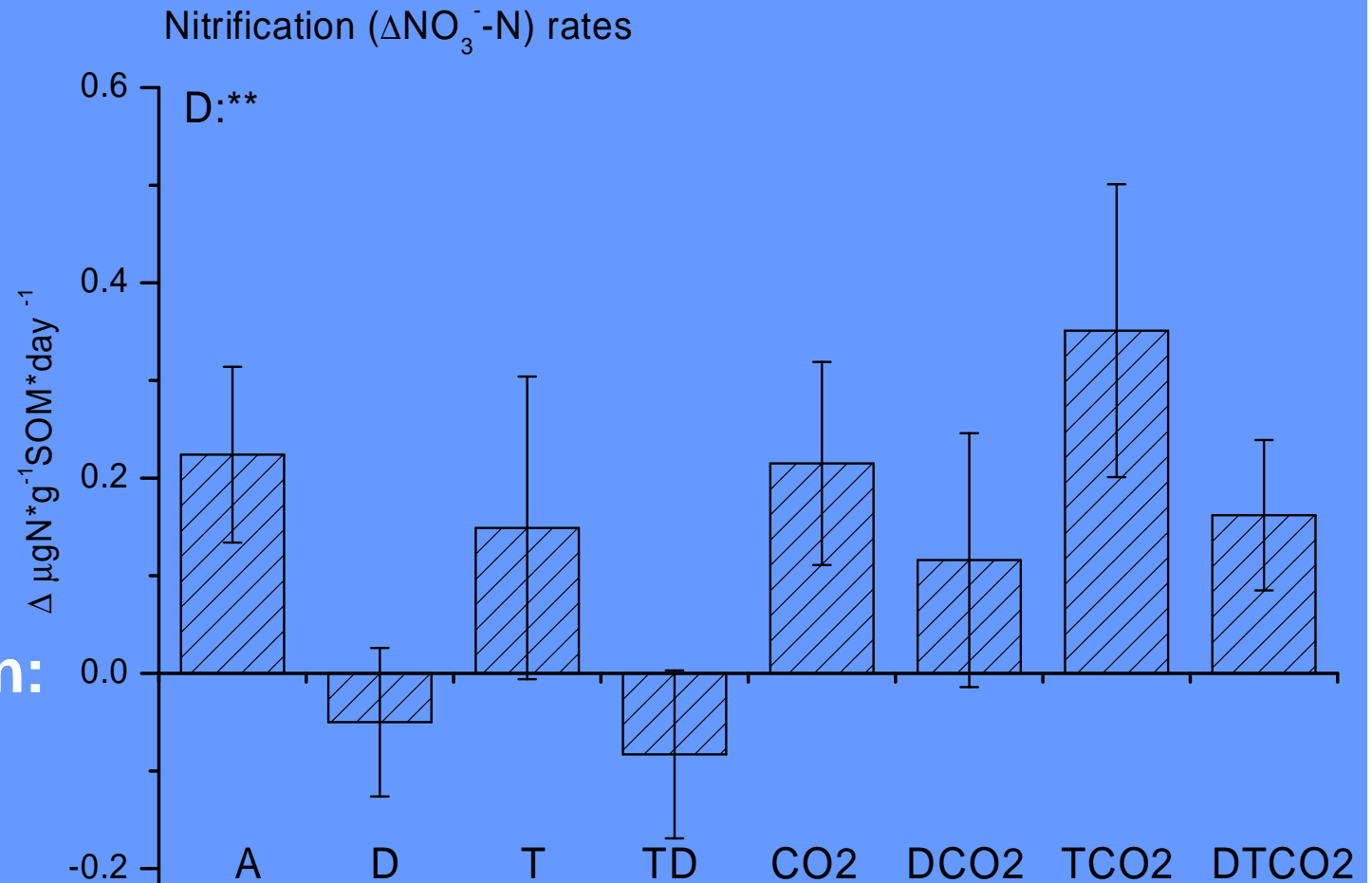
**rate:**

**D ↓**

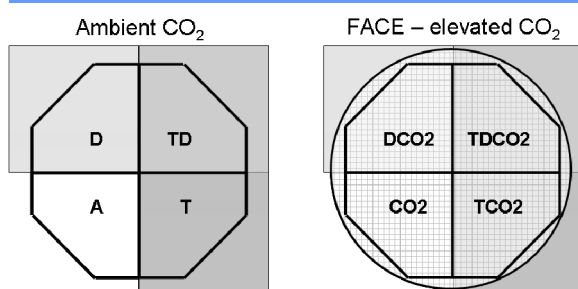
**ALSO litter**

**decomposition:**

**D ↓**



½ year incubated *Deschampsia* soil with no plants



Submitted to Plant and Soil (2009)  
Andresen, Michelsen, Jonasson,  
Mikkelsen, Schmidt, Ambus, Beier

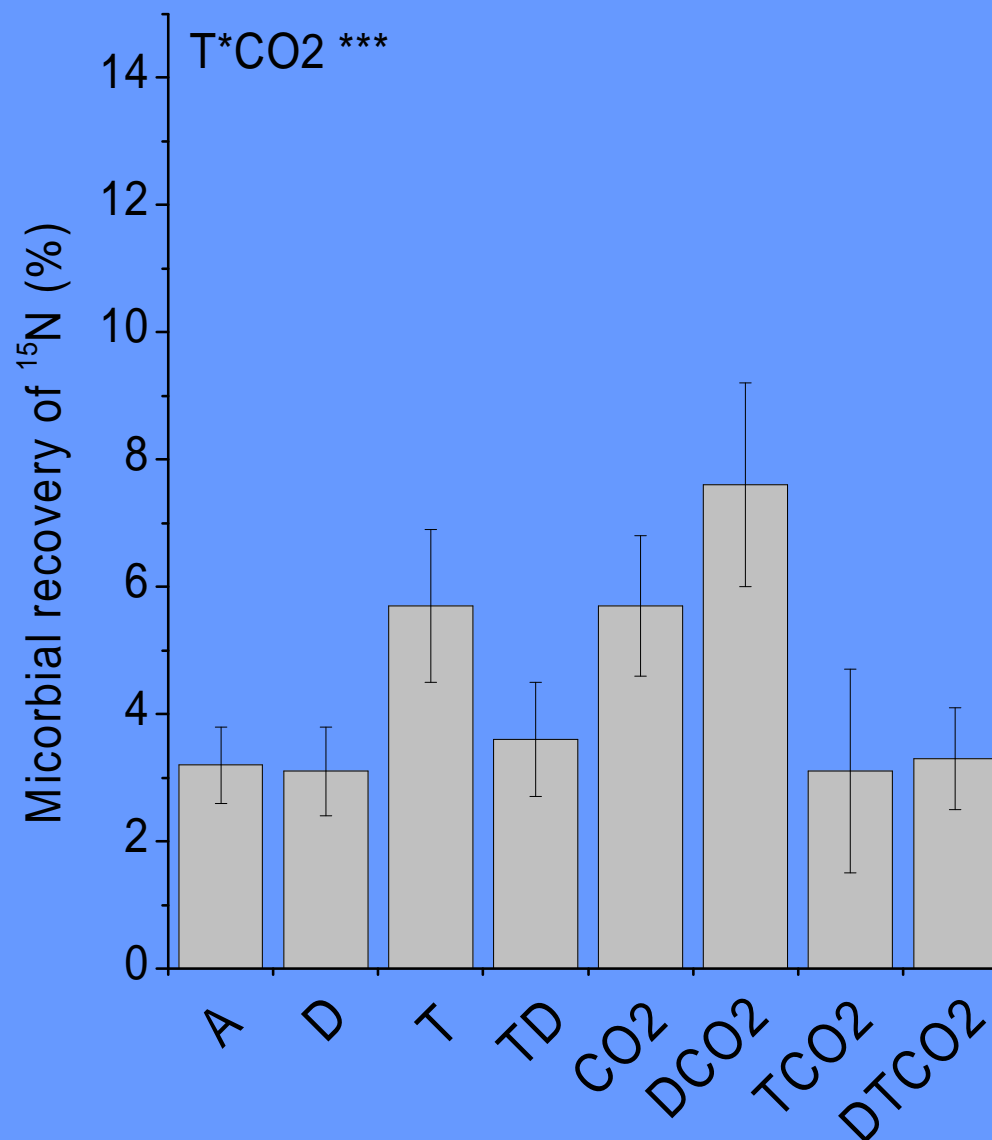
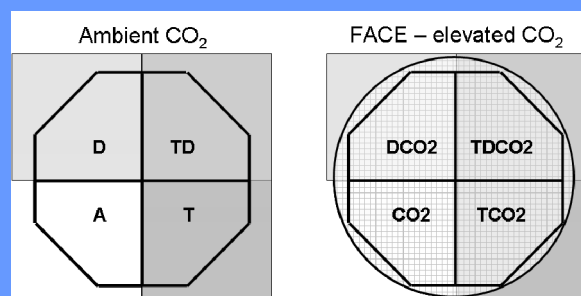


## Microbial $^{15}\text{N}$ recovery:

T ↑

CO<sub>2</sub> ↑

TCO<sub>2</sub> --





TWO years of climate change treatments:

- Combined warming and elevated CO<sub>2</sub> kicks up mineralization of DON into ammonium
- Microbial biomass C and <sup>15</sup>N tracer recovery higher in warmed and elevated CO<sub>2</sub> plots (not in TCO<sub>2</sub>)
- CO<sub>2</sub> dilutes nitrogen in Heather flowers (and fine roots)
- Drought increases Heather N pool, biomass and tracer recovery

**Papers from the field site:**

Experimental design: Mikkelsen *et al.*  
Functional Ecology 2008, vol **22**, 185 – 195.

N and P application: Nielsen *et al.* Applied  
Soil Ecology 2009, vol **42**, 279 – 287.

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Air Liquide

DONG

Jægersprislejen

